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EVALUATION OF SOME EGYPTIAN COTTON VARIETIES TO INFESTATION OF PIERCING SUCKING INSECTS, COTTON LEAFWORM AND BOLLWORMS AT KAFR EL-SHEIKH REGION

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ABSTRACT

Six cotton varieties were evaluated for susceptibility to infestation with certain piercing sucking insects, cotton leafworm and the pink and spiny bollworms at the Experimental Farm, Sakha Agricultural Research Station (North Delta) during 2002 and 2003 seasons. The highest numbers of aphids existed on cotton variety Giza 85, while Giza 89 and Giza 70 harboured the least numbers. However, Giza 45 and Giza 89 were the least infested varieties with whiteflies and jassids which showed the highest affinity to varieties Giza 89 and Giza 86, respectively.

On the other hand, Giza 88 attained the highest number of cotton leafworm larvae, while Giza 89 exhibited the lowest number of this insect. Also, Giza 45 (late bloomer variety) was the most susceptible to infestation with *Pectinophora gossypiella* (Saund.) and *Earias insulana* (Boisd.) and harboured the highest numbers of larvae of the two bollworms. However, Giza 89 (early bloomer variety) was the most resistant one to both bollworms.

The combined effect of temperature, relative humidity and wind velocity was more pronounced on piercing sucking insect populations on Giza 45 and Giza 85 varieties in the second season, with values of 71.50 and 70%, respectively.

INTRODUCTION

The Egyptian cotton lint is highly valued worldwide and is one of the major sources of foreign currency to the Egyptian national income. Cotton plants are subjected to attack by a wide range of insect pests throughout growing stages until near maturity. Among the main insect pests are aphid, *Aphis gossypii* Glover, whitefly, *Bemisia tabaci* (Genn.), jassids, *Empoasca lybica* (De Berg), green stink bug, *Nezara viridula* (L.), pink bollworm, *Pectinophora gossypiella* (Saund.), spiny bollworm, *Earias insulana* (Boisd.) and cotton leafworm, *Spodoptera littoralis* (Boisd.). In addition to sucking the sap of plant tissues, virus diseases, transmitted by some of sucking insects, may increase the severity of the injury and reduce the yield (Buttler *et al.*, 1986; Andrews & Kitten, 1989 and Harris *et al.*, 1992). The cotton leafworm may severely defoliate the plants, resulting in too much losses.

The most serious damage to cotton is a result of honeydew excreted by certain sucking insects which makes the lint sticky, resulting in difficulties in the ginning and spinning process (Perkins, 1987 & Anonymous, 1989). In Egypt, bollworms are well known insect pests causing considerable damage to squares, flowers and green bolls (Khalifa *et al.*, 1974).

Differences in the susceptibility of cotton varieties to bollworm and cotton leafworm infestations have been previously reported, i.e. Lukefahr *et*

al., 1966; Lukefahr and Martin, 1966; Scales and Stadelbacher, 1972; Abdel-Rahim *et al.*, 1976; Abou-Toor *et al.*, 1989 and Abdel-Halim *et al.*, 2000.

Chemical control of these insects is expensive and environmentally disruptive and largely ineffective. Therefore, it is strictly necessary to select resistant varieties as one of the simplest and useful tactics in integrated pest management programmes.

The present investigation aims to evaluate the susceptibility of the most important Egyptian cotton varieties to infestation by the above-mentioned sucking insects, cotton leafworm and the pink and spiny bollworms and relation to some prevailing climatic factors at Kafr El-Sheikh region.

MATERIALS AND METHODS

Six Egyptian cotton varieties were selected for this study namely: Giza 45, Giza 70 and Giza 88 (extra long staple), Giza 85, Giza 86 and Giza 89 (long staple). This experiment was conducted at Sakha Agricultural Research Station, Kafr El-Sheikh Governorate, north Delta during 2002 and 2003 seasons.

Plot size measured 42 m^2 (1/100 feddan) with four replicates for each variety, arranged in a complete randomized block design. Therefore, the experimental field contained 24 plots. Cotton was sown on March 25th, 2002 and on March 30th, 2003, adopting the normal agricultural practices of irrigation and fertilization including three recommended insecticidal treatments as follows:

1st treatment: Applied in July with Dursban (chlorpyrifos) 48% E.C. at a rate of 1 liter/feddan, Atabron 5% E.C. (IGRs) at a rate of 400 ml/fed., 2nd treatment: in July and August (two weeks after the 1st treatment) with Sumialpha (esfenvalerate) 5% E.C. at a rate of 600 ml/fed., Curacron (profenofos) 72% E.C at a rate of 750 ml/fed., and 3rd treatment in August and September with Larvin (thiodicarb) 80% at a rate of 250 ml/fed., curacron 72%, E.C.

Every insecticide was sprayed at 2-week intervals starting from July using the recommended rate of the proper insecticide diluted with 400 liters water. All sprays were conducted using knapsack sprayer (CP_3 Model).

1. Count of piercing sucking insects and cotton leafworm:

Weekly counts of the total numbers of *A. gossypii, B. tabaci* (adults), *E. lybica, N. viridula, S. littoralis* larvae were recorded on 20 seedlings/variety early in the cotton season and on 20 leaves/variety later on, selected at random in each plot.

Records of temperature, relative humidity and wind velocity during 2002 and 2003 seasons were obtained from Meteorological Station at Sakha Agricultural Research Station. Weather records of seven days preceding the sampling date was used to calculate the simple correlation, multiple regression and explained variance according to Fisher (1950).

2. Examination of flowers, squares and green bolls:

Weekly examination of flowers and squares per twenty plants started from the first week of June up to the end of the season. Also, weekly random

samples of 25 green bolls were collected from each plot (100 green bolls as total) and then examined from the second week of July until the end of September. Percentages of infestation were determined as bolls containing larvae, also, the total number of larvae were counted. Duncan's multiple range test (DMRT) (1955) at 5% level was used to reveal significance among the means of the insects attacking the considered varieties.

RESULTS AND DISCUSSION

I. Susceptibility of Egyptian cotton varieties to insect infestation:

Piercing sucking insects infestation:

Data in Table (1) show the mean numbers of *A. gossypii, B. tabaci, E. lybica* and *N. viridula* on five Egyptian cotton varieties during 2002 and 2003 seasons. Statistical analysis revealed that the highest numbers of aphids were existed significantly on variety Giza 85 with means of 7.76 & 4.14 insects/leaf while Giza 89 and 70 harboured the least numbers with means of 2.42 & 1.23 and 3.80 & 1.82 insects/leaf in both seasons, respectively.

Regarding whitefly, *B. tabaci*, Giza 89 and 85 were significantly the most susceptible varieties to infestation with means of 58.44 & 59.15 and 54.41 & 47.17 insects/leaf in both seasons, respectively. On the other hand, Giza 45 and Giza 70 were the least infested with means of 27.69 & 28.50 and 27.87 & 29.16 insects/leaf in both seasons, respectively.

Table (1): Mean number of piercing sucking insects per cotton leaf on different cotton varieties during 2002 and 2003 seasons at Kafr El-Sheikh region.

Insect pests	2002 season				
	Variety				
	Giza 45	Giza 70	Giza 85	Giza 86	Giza 89
A. gossypii	5.24 ab	3.80 a	7.76 b	4.29 a	2.42 a
B. tabaci	27.69 a	27.87 a	54.41 ab	49.82 ab	58.44 b
E. lybica	1.41 a	1.17 ab	1.12 ab	1.95 c	0.87 a
N. viridula	0.07 a	0.10 a	0.09 a	0.03 a	0.08 a
Total mean	34.41 a	32.94 a	63.38 b	56.10 b	61.81 b
	2003 season				
A. gossypii	4.08 a	1.82 a	4.14 b	1.62 a	1.23 a
B. tabaci	28.50 a	29.16 a	47.17 bc	40.96 ab	59.15 c
E. lybica	2.38 a	1.86 a	1.51 a	2.46 a	1.31 a
N. viridula	0.08 a	0.04 a	0.06 a	0.02 a	0.07 a
Total mean	35.04 a	32.88 a	52.88 b	45.07 b	61.76 b

Means with the same letter are not significantly different at P < 0.05 by DMRT

As for jassids, statistical analysis revealed that Giza 89 harboured the lowest number of jassids with means of 0.87 and 1.31 insects/leaf followed by Giza 85 and Giza 70, while the highest affinity to infestation occurred on Giza 86 in both seasons.

With regard to green stink bug, *N. viridula*, statistical analysis revealed no significant differences among the tested cotton varieties in both seasons (Table 1).

From the aforementioned results, it is clear that Giza 89 was the most susceptible variety to whitefly infestation, whereas it was the least infested with both aphids and jassids. This result may be due to the competition for the source of food and/or other factors.

Concerning the total count of the four sucking insects, statistical analysis confirmed that Giza 89 harboured the highest numbers with means of 61.81 and 61.76 insects/leaf followed by Giza 85, Giza 86 with means of 63.38 & 52.88 and 56.10 & 45.07 insects/leaf in both seasons, respectively. On the other hand, the lowest populations were found on Giza 70 and Giza 45 without significant differences. These results are in agreement with those of Abdallah (1979), Salem *et al.* (1992) and Khalafalla *et al.* (1997).

***S. littoralis* infestation:**

Data in Table (2) revealed that Giza 88 attained the highest number of cotton-leafworm larvae followed by Giza 85 with means of 0.32 and 0.18 larvae/leaf, respectively, while Giza 89 exhibited the lowest number of cotton leafworm with a mean of 0.09 larvae/leaf. Tall cotton plants characterized by flat leaf surface, globulous leaves, wide leaf surface and shallow edge notches receive more egg-laying moths (Kamel, 1963). Also, Madkour (1969) stated that the differences in the nature of the vegetative growth were considered the prime factor in egg-laying preference. Abou-Toor *et al.* (1989) found that Giza 75 was highly susceptible and most preferable for egg-laying while the least average of laid egg-masses was found on Giza 69.

Table (2): Mean numbers of *S. littoralis* larvae (Boisd.) (different instars) per one leaf of cotton varieties in 2003 season.

Inspection	Variety			
date	Giza 45	Giza 85	Giza 88	Giza 89
2/6	0.0	0.02	0.02	0.0
9/6	0.10	0.0	0.02	0.12
16/6	0.05	0.50	0.0	0.07
236	0.45	0.53	0.18	0.25
30/6	0.14	0.35	2.37	0.08
7/7	0.11	0.47	0.75	0.05
14/7	0.05	0.05	0.05	0.15
21/7	0.0	0.02	0.02	0.0
28/7	0.0	0.0	0.0	0.30
4/8	0.15	0.30	0.22	0.50
11/8	0.08	0.12	0.37	0.0
18/8	0.60	0.45	0.20	0.0
25/8	0.17	0.25	0.40	0.0
1/9	0.05	0.07	1.05	0.02
8/9	0.0	0.02	0.05	0.02
15/9	0.01	0.01	0.0	0.0
22/9	0.0	0.0	0.0	0.0
29/9	0.0	0.0	0.0	0.0
Total	1.96	3.16	5.70	1.56
Mean	0.11 a	0.18 a	0.32 a	0.09 a

Means with the same letter are not significantly different at $P < 0.05$ by DMRT

c. *P. gossypiella* infestation:

As shown in Table (3), data revealed that Giza 45 harboured the highest numbers of *P. gossypiella* larvae (16.75 larvae/100 bolls) followed by Giza 85 (16.58) and Giza 88 (15.08), respectively, while Giza 89 had the lowest numbers of larvae (3.50). In this respect, Dalia M. Shawer (2000) recorded the highest numbers of *P. gossypiella* larvae on Giza 45 while Giza 88 had the lowest number at Kafr El-Sheikh region. Data obtained indicated that flowers of Giza 45 suffered the highest infestation of *P. gossypiella*. Statistical analysis reveled that Giza 89 was significantly the least susceptible variety to flowers infestation by *P. gossypiella* with a mean of 0.82 insects/20 plants. Infestation of green bolls by pink bollworm indicated that Giza 45 and Giza 85 were the most susceptible varieties while Giza 89 was the most resistant one. This may be due to the early blooming of Giza 89, a phenomenon which help escaping the heavy attack occurring at the end of the season. This result agree with Hassanein *et al.* (1969), Abdel-Rahim (1976), Abou-Toor *et al.* (1989) and Abdel-Halim *et al.* (2000) who found that Giza 45 (late bloomer variety) was the most susceptible to *P. gossypiella* infestation.

Table (3): Mean numbers of pink bollworm larvae, flowers infestation and percentage of green bolls infestation on different cotton varieties during 2003 season.

Cotton varieties	Giza 45	Giza 85	Giza 88	Giza 89
Mean numbers of larvae	16.75 a	16.58 a	15.08 a	3.50 b
Mean numbers of flowers infestation	1.45 a	1.27 a	1.10 a	0.82 a
% of green bolls infestation	13.17 a	12.25 a	11.42 a	3.33 b

Means with the same letter are not significantly different at P < 0.05 by DMRT

***E. insulana* infestation:**

Results in Table (4) indicated that Giza 45 had the highest numbers of *E. insulana* (8.83 larvae/100 bolls) followed by Giza 85 (8.33) and Giza 88 (4.75), respectively while Giza 89 harboured the lowest numbers of larvae (3.83/100 bolls). Data revealed the highest affinity to squares infestation by *E. insulana* occurred on Giza 85. Statistical analysis indicated that Giza 89 was significantly the least susceptible variety to squares infestation by *E. insulana* with a mean of 5.07 insect/20 plants. Infestation of green bolls by spiny bollworm revealed that Giza 45 and Giza 85 were the most susceptible varieties while Giza 89 was the most resistant one. These results are in agreement with those of Abdel-Rahim *et al.* (1976), Abou-Toor *et al.* (1989) and Abdel-Halilm (2000).

Table (4): Mean numbers of spiny bollworm larvae, squares infestation and percentage of green bolls infestation on different cotton varieties during 2003 season.

Cotton varieties	Giza 45	Giza 85	Giza 88	Giza 89
Mean numbers of larvae	8.83 a	8.33 a	4.75 b	3.83 b
Mean numbers of flowers infestation	13.75 a	17.21 a	13.50 a	5.07 b
% of green bolls infestation	7.83 a	7.67 a	4.50 b	3.83 b

Means with the same letter are not significantly different at P < 0.05 by DMRT

However, the differences in susceptibility of plant varieties to pest infestation may be due to morphological and/or biochemical characters (Kumar, 1984). He added that a variety that exhibits resistance in one locality or environment may be susceptible in another one.

II. Effect of some climatic factors on the total population of the four piercing sucking insect:

The changes of insect population are commonly correlated with corresponding changes in its physical environment. Therefore, the effect of some prevailing climatic factors on the populations of the considered insects was studied and the obtained results are depicted in Tables (5 & 6).

Table (5): Statistical parameters for correlation between the total numbers of the four piecing sucking insects recorded on cotton varieties and the climatic factors during 2002 season.

Variety	Daily mean temperature		Daily mean relative humidity		Daily mean wind velocity		% explained
	Simple correlation	Multiple regression	Simple correlation	Multiple regression	Simple correlation	Multiple regression	variance
Giza 45	0.179	4.056	-0.265	-1.423	-0.263	27.181	21.70
Giza 70	0.374	10.766	0.239	-1.431	-0.254	-0.215	44.10
Giza 85	0.118	23.77	0.059	-9.775	-0.185	-30.709	18.60
Giza 86	0.300	29.144	0.143	-5.683	-0.183	11.19	33.00
Giza 89	0.173	31.639	0.049	-11.045	-0.190	-12.25	30.10

Tabulated r at 0.05 level = 0.456
Tabulated r at 0.01 level = 0.575

Table (6): Statistical parameters for correlation between the total numbers of the four piecing sucking insects recorded on cotton varieties and the climatic factors during 2003 season.

Variety	Daily mean temperature		Daily mean relative humidity		Daily mean wind velocity		% explained
	Simple correlation	Multiple regression	Simple correlation	Multiple regression	Simple correlation	Multiple regression	variance
Giza 45	0.460*	-4.396	0.824**	9.547*	-0.340	26.141	71.50
Giza 70	0.558*	-7.444	0.754**	9.374*	0.053	23.861	61.30
Giza 85	0.441	-7.370	0.818**	15.299**	-0.291	1.164	70.00
Giza 86	0.442	-5.394	0.774**	13.127**	-0.199	47.976	65.70
Giza 89	0.244	-4.337	0.778**	16.722*	0.212	56.855	65.20

Tabulated r at 0.05 level = 0.456
Tabulated r at 0.01 level = 0.575

Statistical analysis of the results showed a positive and insignificant relationship between daily mean temperature and the total populations of the four insects in all tested varieties in both seasons except for Giza 45 and Giza 70 in the second season, the relationship was positive and significant. This means that the temperature was within the optimal range for the populations activity of the insects on all cotton varieties except for Giza 45 and Giza 70 where the temperature was out of the optimal range for the activity of insects. Similar results were obtained by Khalafalla *et al.* (1997) who found a positive and insignificant relationship between daily mean temperature and the total

populations of the three sucking insects on all tested varieties except for Dandara and Giza 80, since the relationship was positive and significant.

The results also revealed that the relative humidity was within the optimal range for insects activity on all tested varieties in the first season, since the effect was insignificant and positive except for Giza 45 which was negative. On the other side, in the second season, a positive and highly significant effect was obtained on all tested varieties. This means that the relative humidity was out of the optimal range for the activity of these insects.

It is clear that the populations were negatively affected significantly with wind velocity on all the tested varieties in both seasons except for Giza 70 and Giza 89, the effect was positive. This means that the wind velocity was within the optimal range for the activity of the insects on all the varieties. Results agree with those of Salem *et al.* (1992) who found that daily mean of relative humidity affected *A. gossypii* infestation on Giza 70, Dandara and Giza 81 insignificantly positive while the daily mean of wind velocity influenced it negatively insignificantly. At the same trend, Khalafalla *et al.* (1992) who reported that the population density of both aphids and whiteflies was affected positively by the relative humidity and negatively by the wind velocity on Giza 76, Giza 77 and Giza 80 at Kafr El-Sheikh region.

As for the combined effect of the three climatic factors on the altogether insect populations as percentage of explained variance, it is clear that the effect was more pronounced on the total populations for Giza 45 and Giza 85 than on other varieties in the second season, since it was 71.50 and 70%. On the other hand, the total populations were less affected by the three factors collectively on all cotton varieties in the first season, where it was 44.10 and 33% on Giza 70 and Giza 86, respectively.

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تقييم بعض أصناف القطن المصرية للإصابة بالحشرات الثاقبة الماصة ودودة ورق القطن وديدان اللوز فى منطقة كفرالشيخ

جمال على المزين

معهد بحوث وقاية النباتات ــ محطة البحوث الزراعية بسخا ــ مركز البحوث الزراعية

أجرى هذا البحث بمزرعة محطة البحوث الزراعية بسخا ــ كفرالشيخ ــ شمال الدلتا لدراسة حساسية ستة أصناف قطن مصرية للإصابة بالحشرات الثاقبة الماصة ودودة ورق القطن ودودتى اللوز القرنفلية والشوكية خلال موسمى ٢٠٠٢م ، ٢٠٠٣م.

أوضحت النتائج أن أعلى تعداد للمن على الصنف جيزه ٨٥ بينما كان أقل تعداد على الصنف جيزه ٨٩ وجيزه ٧٠ وكان الصنف جيزه ٤٥ وجيزه ٨٩ أقل إصابة بالذبابة البيضاء والجاسيد على الترتيب بينما كان الصنف جيزه ٨٩ أكثر إصابة بالذبابة والصنف جيزه ٨٦ أكثر إصابة بالجاسيد.

من ناحية أخرى احتوى الصنف جيزه ٨٨ على أكبر عدد من يرقات دودة ورق القطن ، بينما احتوى الصنف جيزه ٨٩ أقل عدد من يرقات الحشرة كما وجد أيضا أن الصنف جيزه ٤٥ هو الأكثر إصابة بدودتى اللوز القرنفلية والشوكية كما احتوى على أكبر عدد من يرقات هاتين الحشرتين بينما كان الصنف جيزه ٨٩ أكثرها مقاومة.

كان التأثير المشترك للعوامل الجوية الثلاثة (الحرارة ــ الرطوبة النسبية ــ سرعة الرياح) أكثر وضوحا على المجموع الكلى للحشرات الأربعة على الصنف جيزه ٤٥ ، ٨٥ حيث أنه أثر على التعداد الكلى لهذه الحشرات بنسبة ٧١,٥% ، ٧٠,٠% على كلا الصنفين على الترتيب وذلك فى الموسم الثانى.